Issues of Co-ordinate Collection Technologies for Rural Property Boundary Surveys in Queensland

by
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Bachelor of Applied Science (Surveying) 1989
Diploma of Electronics 1992

A THESIS
submitted in partial fulfilment of the requirements for the degree of

Master of Applied Science (Research)

Centre for Built Environment and Engineering Research
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Abstract of the Thesis

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The use of co-ordinates as a description of land boundaries and their limitations has been investigated given recent advances in GPS measurement technology and its proliferation in the surveying and mapping industry. While the use of coordinate information is in essence a representation of reality at a given point in time, it is shown that they can be used within a well-defined framework for summary purposes.

The conceptual and operational elements of a measurement-based spatial information system are developed in order to determine if it could aid in the organisation of land boundary information. The fundamental concepts of this information system are that measurements are the primary carriers of metric information. The investigation reveals that measurement-based concepts can serve as the foundation of a multi-purpose spatial information system. Increasing instrument precisions available to surveyors are providing quality measurements with decreasing uncertainties from standard daily operations. Much of this measurement information is in digital form and can provide useful additions of new information as and when they become available to the system. Control measurements are integrated into the system in the same manner as cadastral measurements. The addition of measurements increases the accuracy of the information system over time.

The concept of a local controlled area and surface movement indicators are briefly covered relating to geo-movements of cadastral evidence. Some issues surrounding the historical foundations of geodetic datums are studied as they provides a basis of knowledge of where future spatial information developments may occur given current understandings and technological ability. A review of International and Australian measurement systems is presented. In this context, issues surrounding GPS traceability are explored as a means of demonstrating conformance with suitably recognised quantities of length and time. Discussion is held on the legal acceptance of measurements and reviews rules of evidence questioning the term geographical position used in Australian courts.

An investigative study into rural property boundary surveys for subdivision purposes has been undertaken to provide comparative discussion on issues of changing methods and evolving technology approaches to the measurement challenges using GPS techniques.

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LIST OF ABBREVIATIONS

AFN	Australian Fiducial Network
AGCC	Australian Global Navigation Satellite System Coordination Committee
AGD66	Australian Geodetic Datum 1966
AGD84	Australian Geodetic Datum 1984
AGSO	Australian Geological Survey Organisation
AHD	Australian Height Datum at 1971
ALS	Airborne Laser Scanning
ANN	Australian National Network
ANS	Australian National Spheroid
AMG66	Australian Map Grid 1966
AMG84	Australian Map Grid 1984
AMIS	Asset Management Information System
ARGN	Australian Regional GPS Network
ASDI	Australian Spatial Data Infrastructure
AUSLIG	Australian Surveying and Land Information Group
BBS	Computer Bulletin Board Service
BIML	International Bureau of Legal Metrology (*Bureau International de Metrologie Legale*, BIML)
BIPM	Bureau International des Poids et Mesures (BIPM)
BS	Integrity Monitoring Network Base System (Base Station)
C/A code	Clear Access Code or Coarse Acquisition Code
CCTF	Consultative Committee for Time and Frequency (BIPM)
CORS	Continuously Operating Reference Station
CPD	Continuing Professional Development
CRS	Celestial Reference System
CRTP	Commercial Receiver Test Program
DCDB	Digital Cadastral Data Base
DNR	Department of Natural Resources Qld Australia
DoD	Department of Defence (U.S.)
DOP	Dilution of Precision
DORIS	Doppler Orbitography and Radio positioning Integrated by Satellite
DOTARS	Commonwealth Department of Transport and Regional Services
EDM	Electronic Distance Measurement
FIG	International Federation of Surveyors
FGCS	Federal Geodetic Control Subcommittee (USA)
FSV	Fast Static Vector

GDA94	Geocentric Datum of Australia at 1994
GDOP	Geometric Dilution of Precision
GIS	Geographic Information System
GLONASS	Global Orbiting Navigation Satellite System
GNSS	Global Navigation Satellite System
GP	General Practitioner (medical)
GPS	Global Positioning System
GRS80	Geodetic Reference system 1980
IAG	International Astronomical Union
IAU	International Astronomical Union
ICAO	International Civil Aviation Authority
ICRF	International Celestial Reference Frame
ICRS	International Celestial Reference System
ICSM	Intergovernmental Committee on Surveying and Mapping
ICSU	International Council for Science Union
IERS	International Earth Rotation Service
IGS	International GPS for Geodynamics Service
ILAC	International Laboratory Accreditation Cooperation
IPS	Ionospheric Prediction Service
ISO	International Standards Organisation
ITRF	International Terrestrial Reference Frame
ITRS	International Terrestrial Reference System
IUGG	International Union of Geodesy and Geophysics
LCA	Local Controlled Area
LIS	Land Information System
LLR	Lunar Laser Ranging
LOTS	Land Ownership & Tenure System (South Australia)
LRIS	Land Registration & Information Services (Canada)
LWG	Legal Working Group of AGCC
MBLIS	Measurement Based Land Information System
MBSIS	Measurement Based Spatial Information System
Met	Meteorological Observation
MGA94	Map Grid of Australia 1994
MRA	Mutual Recognition Arrangement derived from BIPM
MSL	Mean Sea Level
NAVSTAR	Navigation Satellite Timing and Ranging
NATA	National Association of Testing Authorities, Australia
NBS	National Bureau of Standards (USA)

NIMA	National Image Mapping Agency (formally US Department of Mapping (DMA))
NMI	National Metrology Institutes
NML	CSIRO National Measurement Laboratory
NR&M	Queensland Department of Natural Resources & Mines.
NZGD49	New Zealand Geodetic Datum 1949
OIML	International Organisation for Legal Metrology
OTF	On The Fly (GPS ambiguity resolution)
P code	Precision or Private Code for GPS
PDOP	Position Dilution of Precision
PPM	Parts Per Million
QA	Quality Assurance
QLIC	Qld Land Information Council
QSIIC	Qld Spatial Information Infrastructure Council
RINEX	Receiver Independent Exchange Format
RMS	Root Mean Squared
RTK	Real Time Kinematic
SCIGN	Southern California Integrated GPS Network
SCDB	Survey Control Data Base (NR&M Queensland)
SDI	Spatial Data Infrastructure
SI	International System of Units (Systeme International)
SIS	Spatial Information System
SLR	Satellite Laser Ranging
SNR	Signal to Noise Ratio
SP1	Standards and Specifications for Control Surveys, Special Pub. No. 1
TQM	Total Quality Management
TSB	Territorial Sea Baseline
UHF	Ultra High Frequency (radio communication)
UN	United Nations
UNCLOS	United Nations Convention on Law Of the Sea
US DoD	United States Department of Defence
UTC	Universal Time Coordinated.
VCV	Variance-CoVariance
VHF	Very High Frequency (radio communication)
VLBI	Very Long Baseline Interferometry
VRS	Virtual Reference System
WAAS	Wide Area Augmentation System
WGS84	World Geodetic System 1984

DECLARATION BY THE CANDIDATE

Statement of Original Authorship

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signed: ……

Date: ……

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